might be considered as a mere variety), and the *Phoxinus poljakowi*, which is nearly akin to the *Ph. lævis* of the Obi and North-East Europe. From these facts M. Nikolsky concludes that if a direct communication between Lake Balkash and Lake Aral has ever existed—that is, if a marine basin ever covered once the three depressions of the Alatau, the Aral-Caspian, and Siberian—the former was separated from the two latter at a much earlier period than the time when, at least, a fluviatile connection between the Aral-Caspian and the Siberian Ocean had ceased to exist. The separation must have taken place earlier than the separation of the two continents of Asia and America. If a connection existed between the Balkhash and the Irtish during the Post-Tertiary period, it could be only by means of shallow streams where the *Phoxini* could live. On the contrary, the Balkhash and the Lob-nor remained connected after the above separation took place. The connection was carried on through Kunges, the Yuldus, and Tarim. The limits of this basin can be easily determined.

MESSRS. SWAN SONNENSCHEIN AND CO. will publish in a few days a "Tourist's Guide to the Flora of the Alps," translated from the German of Prof. Dalla-Torre, and issued under the auspices of the German and Austrian Alpine Club of Vienna. The volume will appear in the form of a handy pocket-book.

THE additions to the Zoological Society's Gardens during the past week include a Chacma Baboon (*Cynocephalus porcarius* ♂) from South Africa, a Malbrouck Monkey (*Cercopithecus cynosurus* ♀) from West Africa, presented by Lieut.-Gen. G. W. A. Higginson, C.B.; a Rhesus Monkey (*Macacus rhesus* ♀) from India, presented by Mrs. J. J. Buchanan; a Macaque Monkey (*Macacus cynomolgus* ♂) from India, presented by Mr. H. M. Sharratt; a Common Badger (*Meles taxus* ♂), British, presented by the Hon. Walter de Rothschild; four Moorhens (*Gallinula chloropus*), British, presented by Mr. T. E. Gunn; three Gold Pheasants (*Thaumalea picta* ♂ ♂ ♂) from China, presented by Mr. A. Heywood, F.Z.S.; a Hygian Snake (*Elaps hygiæ*), a Hoary Snake (*Coronella cana*), a Crossed Snake (*Psammophis crucifer*) from South Africa, presented by the Rev. G. H. R. Fisk, C.M.Z.S.; two Great Cyclodus (*Cyclodus gigas*), two Stump-tailed Lizards (*Trachydosaurus rugosus*) a Diamond Snake (*Morelia spilotes*) from Australia, received in exchange.

OUR ASTRONOMICAL COLUMN

PHOTOGRAPHIC EVIDENCE AS TO THE CONSTITUTION OF SUNSPOTS.—M. Janssen, remarking on some exquisite photographs of sunspots which he has obtained during the past year, calls attention to the evidence they supply as to the continuation of the granulation of the general solar surface into the spots. A photograph of the great spot of 1885, June 22, for example, to which he particularly alludes, shows that the bright region which surrounds the penumbræ of large spots has not a different constitution from that of the photosphere in general, since it is made up in like manner of granular elements, usually of a spherical form. The marked increase in brightness of such regions the photographs show to be due to the granulations being more thickly clustered, brighter in themselves, and arranged on a brighter background. In the penumbra the granulations are still distinguishable, but they are less luminous and more scattered, leaving dark gaps between the rows of grains, the familiar striated appearance of the penumbra being due to the arrangement of the granulations in ranks and lines, like beads on a thread. The grains become in general smaller and duller near the nucleus, where they seem to dissolve. The same spot presented two very remarkable bridges, and a very bright isolated mass of luminous matter which united them. This luminous matter and the bridges were also formed of granular elements resembling the others. Many other photographs have revealed a similar structure in penumbræ and their surroundings, so that it is highly probable that "the luminous matter which forms the solar surface has everywhere the same constitution."

THE STRUCTURE OF THE SOLAR ENVELOPE.—A somewhat lengthy paper by M. Trouvelot, on the above subject, originally published in the *Bulletin Astronomique* for June, August, and September last, has recently appeared. The first part of the paper consists of a *résumé* of a number of striking and typical observations which are illustrated in the plate which accompanies it. These observations principally relate to spots of irregular and complicated form; the most remarkable being those in which M. Trouvelot describes the formation of numbers of bright white points over sunspots, like "a fall of snow," sometimes even obliterating them, the formation of purple vapours in connection with both spots and prominences, and the apparent changes and sometimes complete concealment of spots occasionally produced by faculæ. The essentially granular appearance of the sun, so well brought out in M. Janssen's photographs, has by no means escaped M. Trouvelot's notice, and he has even seen the lines C D_1 D_2 b_1 b_2 b_3 and F as themselves granulated, *i.e.* not uniformly dark, but composed of a great number of whitish points separated by dark intervals. The latter part of the paper is occupied with inferences as to the constitution of the solar envelope resulting from a consideration of these observations. The theory formed resembles in its essential characteristics that so admirably set forth by Prof. Young in his book on the sun. The sun is surrounded by a shell relatively very shallow, made up of innumerable vertical filaments due to the condensation of metallic vapours, and which M. Trouvelot proposes to call the *nematosphere*, in distinction to the photosphere, the glowing summits of these filaments. The behaviour of these filaments under various circumstances is discussed, and the varying effects upon them of hydrogen and metallic eruptions from the solar nucleus below of different degrees of violence is made to account for the varied phenomena of spots, faculæ, and prominences. The brilliance of the photosphere is regarded as due to the high radiating powers of these metallic vapours, when on arriving at the surface of the sun they are condensed, partly from the effect of exposure to the cold of space, and partly from expansion, the granulations being glowing clouds composed of these condensed metallic vapours, the summits of these filaments or columns.

M. Trouvelot expressly contradicts the frequently-made assertion that the bright D_3 line of the chromosphere has no counterpart amongst the dark lines of the spectrum of the disk; the line is indeed an exceedingly fine one, but it is unmistakably present.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1886 FEBRUARY 7-13

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on February 7

Sun rises, 7h. 30m.; souths, 12h. 14m. 22·8s.; sets, 16h. 58m.; decl. on meridian, 15° 14′ S.: Sidereal Time at Sunset, 2h. 9m.

Moon (at First Quarter on Feb. 12) rises, 8h. 47m.; souths, 14h. 39m.; sets, 20h. 41m.; decl. on meridian, 2° 12′ S.

Planet		Rises		Souths		Sets		Decl. on meridian
		h. m.		h. m.		h. m.		° ′
Mercury	...	7 14	...	11 26	...	15 38	...	20 30 S.
Venus	...	7 20	...	13 11	...	19 2	...	2 42 S.
Mars	...	20 4*	...	2 37	...	9 10	...	5 51 N.
Jupiter	...	21 14*	...	3 14	...	9 14	...	0 50 S.
Saturn	...	12 46	...	20 57	...	5 8*	...	22 41 N.

The planet Venus is now very near to inferior conjunction.

* Indicates that the rising is that of the preceding evening and the setting that of the following morning.

Occultations of Stars by the Moon

Feb.		Star		Mag.		Disap.		Reap.		Corresponding angles from vertex to right for inverted image
						h. m.		h. m.		° °
10	...	B.A.C. 741	...	$6\frac{1}{2}$	...	18 6	...	19 12	...	157 286
12	...	48 Tauri ...	...	6	...	20 40	...	21 40	...	93 347
12	...	γ Tauri ...	...	4	...	22 45	...	23 47	...	128 323
13	...	71 Tauri ...	...	6	...	1 43	...	2 25	...	95 345

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Phenomena of Jupiter's Satellites

Feb.		h.	m.		Feb.		h.	m.	
7	...	0	0	I. ecl. disap.	10	...	2	17	III. ecl. disap.
7	...	0	38	II. tr. egr.	10	...	5	11	III. ecl. reap.
7	...	3	8	I. occ. reap.	10	...	5	40	III. occ. disap.
7	...	22	3	I. tr. ing.	12	...	3	43	II. ecl. disap.
8	...	0	18	I. tr. egr.	13	...	5	23	I. tr. ing.
8	...	21	34	I. occ. reap.	13	...	22	3	III. tr. egr.

The Occultations of Stars and Pheromena of Jupiter's Satellites are such as are visible at Greenwich.

Saturn, February 7. Outer major axis of outer ring = 45″·0; outer minor axis of outer ring = 20″·1; southern surface visible.

Feb.		h.		
7	...	6	...	Mars at greatest distance from the Sun.

Variable-Stars

Star	R.A.		Decl.							
	h.	m.	°	′				h.	m.	
U Cephei	0	52·2 ...	81	16	N. ...	Feb.	11,	22	19	*m*
Algol	3	0·8 ...	40	31	N. ...	,,	8,	21	42	*m*
						,,	11,	18	31	*m*
λ Tauri	3	54·4 ...	12	10	N. ...	,,	10,	23	51	*m*
W Virginis	13	20·2 ...	2	47	S. ...	,,	8,	0	0	*M*
δ Libræ	14	54·9 ...	8	4	S. ...	,,	11,	23	54	*m*
U Coronæ	15	13·6 ...	32	4	N. ...	,,	13,	3	5	*m*
S Serpentis	15	16·3 ...	14	43	N. ...	,,	8,			*M*
U Ophiuchi	17	10·8 ...	1	20	N. ...	,,	8,	14	0	*m*
					and at intervals of			20	8	
β Lyræ	18	45·9 ...	33	14	N. ...	Feb.	11,	9	30	*M*
R Lyræ	18	51·6 ...	43	48	N. ...	,,	10,			*m*
δ Cephei	22	24·9 ...	57	50	N. ...	,,	7,	21	30	*m*
						,,	13,	7	0	*m*

M signifies maximum; *m* minimum.

Meteors

There are no important periodical showers at this season of the year. The following are amongst the principal radiants from which meteors may be expected:—Near Capella, R.A. 75°, Decl. 44° N.; three radiants in Ursa Major, R.A. 131°, Decl. 52° N., R.A. 180°, Decl. 56° N., and R.A. 210°, Decl. 53° N.; one from Corona Borealis, R.A. 226°, Decl. 30°; near β Herculis, R.A. 260°, Decl. 0°. February 10 is a fireball date.

Stars with Remarkable Spectra

Name of Star	R.A. 1886·0				Decl. 1886·0				Type of spectrum
	h.	m.	s.		°	′			
72 Schjellerup ...	6	3	49	...	26	2·1	N.	...	IV.
η Geminorum ...	6	8	0	...	22	32·4	N.	...	III.
μ Geminorum ...	6	16	3	...	22	37·5	N.	...	III.
78 Schjellerup ...	6	28	42	...	38	32·2	N.	...	IV.
LL 13412	6	49	12	...	23	46·8	S.	...	Bright lines
51 Geminorum ...	7	6	49	...	16	21·2	N.	...	III.
115 Schjellerup ...	8	48	57	...	17	39·9	N.	...	IV.
120 Schjellerup ...	9	3	46	...	31	25·7	N.	...	III.
R Leo Minor ...	9	38	45	...	35	2·1	N.	...	III.
R Leonis	9	41	26	...	11	57·5	N.	...	III.

BIOLOGICAL NOTES

METAMORPHOSIS IN NEMATODES.—Dr. von Linstow sums up our present knowledge as follows:—The Nematelminthes, according to the medium in which the individual developmental stage is passed, present a truly wonderful series of metamorphoses, and no less than fourteen distinct developmental stages may be enumerated. (1) The embryo passes into an adult form direct (without the intervention of a larval stage) in the one medium, and also passes its existence in fresh, salt, or brackish water, in plants, in the earth, or in decaying substances (Dorylaimus, Enoplus, Plectus, Monhystera, Rhabditis, and many other genera). (2) The larvæ live in the earth, the adult form in plants (*Tylenchus tritici, T. putrefaciens, Heterodera schachtii*). (3) The larvæ live in worms, and on their death and decay pass into the earth, when they assume an adult form (*Rhabditis pellio*). (4) The Helminth lives bisexual in the earth, the fruitful females enter the bodies of bees, and produce therein offspring (*Sphærularia bombi*). (5) The larvæ live in the earth, assuming the adult condition in some animal (Dochmius, Strongylus). (6) The Helminth lives as an hermaphrodite form in some animal, the offspring develop into bisexual forms in the earth (Rhabdonema, Angiostomum). (7) Some adult forms differentiate free-living forms developing sexually, and also hermaphrodite forms living parasitically in animals (snails, *Leptodera appendiculata*). (8) The larvæ hatch out in the earth, and then enter some animal, in which they become metamorphosed into hermaphrodite forms (Trichocephalus, Oxyuris). (9) The larvæ live in insects, the adult form in earth or water (Mermis). (10) The larvæ live encapsuled in some animal, and with it pass into the digestive system of some other animal form, in which latter they become adult (Ascaris, Filaria, Cucullanius). (11) For a short time the hermaphrodite form lives in the intestine of some animal, and produces here its larval form, which, penetrating the intestinal walls, makes its way into the muscles, where it becomes encapsuled (*Trichina spiralis*). (12) The adult form lives in the tracheæ of birds; the females lay eggs, which contain well-formed embryos, which get expectorated, to once again enter the bird's system with its ordinary nourishment. In the crop and œsophagus of the bird the embryo hatches out, wandering into the bronchiæ and air-sacs, from whence the larger larvæ find their way to the tracheæ (*Syngamus trachealis*). (13) There will be two larval forms, of which the one will be found in Mollusca, and the other in aquatic beetles and water-boatmen, while the adult form lives in water (*Gordius aquaticus*). (14) There will be two larval forms, of which the one will be found in water, the other in the lung of some Amphibian, from whence it will wander into the intestine of the same animal, where it will develop into an hermaphrodite form (*Nematoxys longicauda*); this latter form is described and figured.—(*Zeitschrift für wissenschaftliche Zoologie*, November 24, 1885, Band xlii. Heft 4, p. 715, pl. 28.)

ARTIFICIAL PROPAGATION OF OYSTERS.—Mr. W. K. Brooks calls attention in detail to a very important fact in the artificial propagation of oysters to which his notice was first called by Mr. W. Armstrong, of Hampton, Virginia. It would appear that "seed" oysters which Mr. Armstrong had placed on "floating-cars" in the mouth of Hampton Creek not only grew more rapidly, but were of a better shape, and therefore more marketable, than those from seed deposited at the same time in the usual way on the bottom. Immediately after the embryo oyster acquires its locomotor cilia there is a period of several hours, when it swims at the surface, and this is the period when it is swept into contact with collectors. As soon as the shell appears, the larva is dragged down by its weight, and settles at the bottom. The greatest danger to which it is now exposed is that it may not at this stage of its existence find a hard, clean surface for attachment. Being of microscopical dimensions, it may be smothered by a deposit of sediment or mud so light as to be invisible, and most of the failures to get a good "set of spat" are due to the formation of a coat of sediment upon the collectors *before* the young oysters come into contact with them. This danger seems to be entirely avoided by the use of floating collectors, for little sediment can fall on a body which is close to the surface of the water, and most of what may fall will be swept off by the currents which bring the swimming embryo oysters into the collectors. The collector employed by Mr. W. K. Brooks was formed by connecting two old ship-masts together by string pieces, with a bottom of coarse galvanised iron netting which had buoyancy enough to support a large quantity of submerged shells. Such floats should be open at the ends to permit free circulation, and should be so moored as to sway with the current. Mr. Brooks moored a collector, on July 4, in front of the Zoological Laboratory at Beaufort, N.C. Although all the oysters in the vicinity, from being in very shallow water, were nearly through their spawning season, and the conditions were anything but favourable, yet there was immediately secured a good "set," and the young oysters grew with remarkable rapidity, no doubt on account of the abundant supplies of food and fresh water, which gained ready access to all of them, and the uniform temperature which was secured by the constant change of water. The importance of this suggestion is obvious: this method may be used by planters to collect their own supply of seed—an object of great importance—when the feeding regions are far removed from native beds. Perhaps time will prove that it may be also used for rearing the oyster to a stage making it fit for the market; when, if so, the better shape and firmer shell would give the supply thus raised a superior value. Even in places where there are no oysters near to furnish the supply of eggs, a few spawning-oysters could be placed among the shells in the collector, after the French method, to supply the "set." Though, as Mr. W. K. Brooks says, "Engagement in business projects is no part of the [direct] office of a University," still, we venture to hold

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